Introducing Biology Undergraduates to Authentic Research through Grand Challenges in Global Health: Examining Environmental Factors that Influence the Development of Zebrafish Embryos

Swapnalee Sarmah, Grady Chism, Martin Vaughan, James A. Marrs, and **Kathleen A. Marrs**
Department of Biology, Indiana University-Purdue University Indianapolis, Indianapolis

To increase student excitement and engagement in science, a course-based undergraduate research experience **(CURE)** has been introduced in the curriculum at IUPUI. In Fall 2013, original research projects investigating prenatal alcohol, nicotine and caffeine exposure effects on development of zebrafish embryos was introduced into the Introductory Biology K102 course. This research project was also a part of a new Themed Learning Community **(TLC)** at IUPUI called "From Molecules to Medicines" that examined grand challenges in global health. In documenting the developmental effects on zebrafish embryos, and designing new protocols to address student research questions, students gained experience with authentic research methods, laboratory techniques, microscopy, image analyses, statistical analyses, scientific writing and presentation skills. This project, especially in a freshman undergraduate lab setting, requires a new way of problem-solving, but greatly facilitates student excitement and engagement in science through the use of research-based high-impact practices for student success and persistence. To continue an inquiry-based lab on global health issues and to keep IUPUI biology curricula current with the rapid rise of bioinformatics, concepts of bioinformatics were introduced into the Cell Biology Laboratory K325 course in Spring, 2014. Students were allowed to work on their own investigatory projects to analyzed zebrafish microarray data to find genes affected after ethanol exposure. Students used NCBI/ Ensembl databases to retrieve the gene/protein sequences, and various freely available tools (GeneBank, Protein Data Bank, BLAST, ClustalW, ExPasy, Phylogenetic Tree) to investigate the evolutionary conservation of genes/proteins affected after ethanol exposure. Student learnt 3D-protein structure construction and observed how 3D-protein structure could change with single amino acid changes. Preliminary assessment indicates that students are gaining an understanding the web-based databases and tools and enjoying the investigatory nature of the lab exercises.